Closeout Presentations

from the

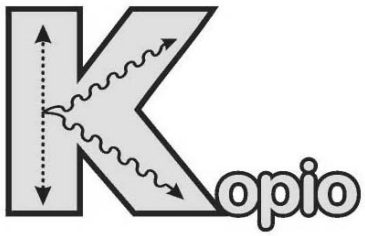
Preliminary Baseline Review

of the

RSVP

Brookhaven National Laboratory
April 6-8, 2005

RSVP
rare symmetry violating processes



NSF

Review of the K0PI0 experiment (1.2)

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Presentations

- During the breakout sessions on Thursday, we had presentations by
  - M. Marx: subsystem review
  - D. Beavis: vacuum system
  - A. Nappi: trigger
  - T. Numao: pre-radiator system
  - V. Issakof: Shashlyk calorimeter
- We “drilled” into the WBS for several subsystems:
  - 1.2.1 vacuum system; an example of a heavily engineered system
  - 1.2.2 preradiator; a system being built in North America
  - 1.2.3 calorimeter; a system being primarily built in Russia

Some general comments:

- 1.1, Project Office is not under our general purview, but the point was driven home to us by the complexity of the experiment that Mike Marx can not run the K0PI0 project without significant administrative support being funded at Stony Brook
- K0PI0 has a significant foreign component; success of the experiment requires the maintenance of a strong integration team at Brookhaven
- …or in other words; RSVP represents a large external contribution to Brookhaven's mission; if Brookhaven truly wants it, this is not the time to be down-sizing Brookhaven staff relating to RSVP
- Clear (recognized) need for extra manpower; some cost-savings may be possible if more work can be given to university groups where many costs are subsidized
- We were impressed by the amount of work that has gone into the conceptual design of the detector to date; clearly, though, much engineering remains to be done
- Additional scrubbing is called for to standardize cost and contingency estimates within subsystems
- Even though experiment has been around in conceptual stage for some time, it's still not mature

1.2 Science/Technology

- KOPIO plans to measure the branching ratio for $K^0_L \rightarrow \pi^0 \nu\nu$ to 10% which will measure the area or height of the unitarity triangle to 5%. The experiment will make an important contribution to our understanding of CP violation and to searches for New Phenomena that might explain the baryon-antibaryon asymmetry of the universe.
- The KOPIO experiment requires a full intensity micro-bunched beam which provides enough kaons and the ability to measure the kaon velocity. The experiment requires extremely good photon vetoing so that the π^0 inefficiency is $< 10^{-8}$. Photon direction and energy will be measured by a pre-radiator and a calorimeter. The beam required is 100 Tp/spill with 25 MHz microbunching frequency and a bunch width of 200 ps. This requires 25Mhz and 100 Mhz cavities. The interbunch extinction is required to be less than 10^{-3}.

1.2.1 Vacuum System

- **This is one of the best-engineered aspects of the experiment**
  - **an outside engineering firm with experience in this area has come on board and a company with a good reputation has been chosen for fabrication of the vacuum vessels**
    - **the fabrication is challenging but not state-of-the art**
  - **the budget and schedule has allowed for redundancy:**
    - **fabrication and testing of a prototype vessel to as much as 3 atmospheres; instrumentation of the vessel will allow the deformations to be compared to the structural model**
    - **fabrication of a final vessel**
      - **if the prototype vessel performs well and is not overly stressed during the testing procedure, then there remains a possibility of its use in the final experiment (possible move of final vessel to contingency?)**
    - **a prototype vacuum membrane will be tested; a spare will be purchased in additional to the final membrane**

1.2.2 Pre-radiator system

- **Measures γ-ray direction and energy loss to constrain kinematics of a kaon decay**
  - **chamber/scintillator system**
    - **8 modules in depth divided into quadrants**
    - **80% efficiency for both conversion of both photons from a π^o; removal of one module for management contingency will reduce this efficiency to 61% (not acceptable)**
  - **primary trigger source**
- **Being built in TRIUMF using both Canadian and NSF money**
  - **manpower is adequate**
  - **scintillator technology uses techniques successfully pioneered by MINOS**
  - **have a source for large FR-4 chamber frames unavailable in the rest of the world**
- **Schedule and costing examined in some detail**
  - **more oversight needs to be identified for chamber production**
  - **contingency estimates may be high in some cases**

1.2.3 Calorimeter system

- By now well-developed Shashlyk technology allows measurement of photon energies with resolution of 3%/root(E)
- Most of assembly takes place in Russia
  - scintillator manufacture in Russia (injection molding; Russian contribution)
  - fiber purchase in US (Bicron)
  - APD purchase in US (Photonics); readout assembly in Russia
  - engineering by Russia; labor paid by NSF
- Relatively cheap labor costs; reasonable cost/schedule risks

1.2.4 Charged particle veto

- Report available on website but no detailed discussion in breakout session
- High efficiency needed
  - location inside vacuum tank requires redundancy in readout of each scintillator->each scintillator read out by 2-3 PMT's
- Standard technology
- Appreciable contributions from Zurich

1.2.5 Photon veto

- **Report available on website but little detailed discussion in breakout session**
- **Uses same Shashlyk technology as calorimeter so costs/risks/schedules have been scaled to scope of subsystems**
- **…but no manpower has been identified to cover project**
- **Given level of rejection necessary, possible inefficiencies due to cracks must be carefully examined**
- **What is level of deadtime due to neutron interactions?**

1.2.6 Catcher

- Report available on website but no detailed discussion in breakout session
- Purpose: detect photons passing through beam hole
  - be very efficient for photon detection
  - neutron blind
- Japanese responsibility and contribution
  - no cost to NSF

1.2.7 Trigger

- The K0PI0 trigger is a fully digital, pipelines system designed for a level 1 accept rate of 1 Mhz which can most likely be built using current technology
- A level 3 software trigger is then used to reduce the rate to a few khz
- The collaboration keeps the option of introducing a level 2 system in case the level 1 trigger cannot achieve the required efficiency/rejection ratio
- The clock distribution scheme is included in the trigger

1.2.7 Trigger

- **The trigger system needs a significant push in engineering and simulation of the level 1, and if needed, level 2 systems. We suggest that all of the level 2 costs should be moved from WBS 1.2.8 (DAQ) to the contingency for WBS 1.2.7 (+$987,459), which would then be 87.6% of the base cost**
- **The availability of a sufficient number of engineers on the required timescale is an open question. It will require attracting groups with the appropriate capabilities in the near future.**
- **The project also needs to attract physicists to work with the engineers and develop the L3 filtering code**

1.2.7 Trigger: Recommendations

- **Invest effort in engineering and simulation of the level 1 system and determine the necessity of a level 2 system**
- **Invest effort in the development of the clock distribution scheme, since it is needed for the front end development**
- **Converge on the architecture for the trigger systems**

1.2.8 DAQ

- The DAQ system includes the optional level 2 system for which the current design is in hardware
- The collaboration expect to take the event building scheme from another experiment, possibly CMS
- The event size is estimataed at 30 kB from counting hits in events simulated with GEANT
- The online controls software is expected to be written mostly by physicists

1.2.8 DAQ

- The event size estimate needs to include a safety factor for effects not reproduced by the simulataion
- The DAQ architecture needs to go through an R&D phase to complete the design and verify its feasibility
- The DAQ system would benefit from a larger involvement of computer professionals in the development/adaptation of the controls software
- The level 2 system is a contingency for the level 1 system and as such should be moved to WBS 1.2.7 contingency

1.2.8 DAQ: Recommendations

- **Increase manpower in the DAQ project significantly**
- **Develop the dataflow architecture and verify its feasibility through simple simulation**

1.2.9 Offline Computing

- The term “offline computing” is not entirely accurate as this WBS item includes processing power for calibration and quasi-real time monitoring, one year data storage and the offline software infrastructure. It does not include long term storage, or full reconstruction and data-handling needs
- The collaboration expects offsite resources for reconstruction, and level 3 and calibration processors during accelerator shutdowns
- The collaboration plans to use the GLAST software infrastructure as a basis for its own

1.2.9 Offline computing

- **The uncertainty in the event size will propagate into the storage, and possibly bandwidth needs. To that effect, the contingency for this part of the project needs to be increased.**
- **Usage of existing GRID resources for offline computing needs is credible given the relative demands of K0PI0 compared to the LHC experiments**

1.2.9 Offline computing: recomendations

- **Put the offline software infrastructure in place asap**
- **Start development of the reconstruction (and level 3) software as soon as this is done**
- **Increase the physicist manpower available to this part of this project**

1.2.10 Detector Systems (Installation)

- **Report available on website but no detailed discussion in breakout session**
- **WBS lists detailed breakout**

1.2.11 Project Services

- **Report available on website but no detailed discussion in breakout session**
- **Currently covers project manager's salary plus 0.5 FTE/year administrative help**
- **Needs to be increased to 2.0 FTE/year help**
- **Role of Columbia vis a vis Stony Brook project office needs to be clarified**

MECO

Technical and Scope: Findings

- MECO plans to measure $\mu N \rightarrow eN$ with a single-event sensitivity of 2×10^{-17}, a factor of $\sim 10^4$ improvement relative to previous experiments. This sensitivity is well below the level expected in many grand unified supersymmetric models. It will also probe a broad range of other proposed extensions to the Standard Model.
- The MECO Experiment requires:
  - An extraordinarily high intensity source of negative muons
  - A high intensity pulsed proton beam with an inter-bunch intensity of 10^{-9} to suppress prompt beam-induced backgrounds
  - A very high acceptance detector system with a resolution of ~200 keV at 105 MeV to reject events from muon decay-in-orbit
- The MECO Experiment has critical components within 3 of the RSVP projects:
  - MECO Detector
  - MECO Magnet
  - AGS

Technical and Scope: Comments

- The combination of the muon production target within a graded solenoidal field, the transport solenoids to momentum and charge select the muons, and the stopping target within a graded solenoidal field should provide a suitable source of stopped muons.
- Achieving a primary proton beam extinction ratio of 10^{-9} at high intensity will be extremely challenging. It is nonetheless **essential** for the experiment to achieve the goal of <1 background event at the target sensitivity. Early high intensity system tests would be valuable to verify the performance of the beam extinction system.
- Two different tracker concepts were presented. The transverse tracker appears to have significant mechanical advantages. Consistent simulations of the relative susceptibility of the longitudinal and transverse trackers to pattern recognition errors in the presence of realistic backgrounds are planned, but have not yet been completed. Pattern recognition errors are likely to be the dominant source of any high-energy tail that could leak decay-in-orbit background events into the signal region.

Technical and Scope: Comments (cont)

- The electron calorimeter conceptual design appears sound. Considerable work on the mechanical aspects is still necessary.
- The importance of the cosmic ray shield for the previous measurement by SINDRUM2 demonstrates the need for a suitable active cosmic ray shield in MECO.
- The requirements for the trigger, DAQ, and offline computing appear to be well understood and under control.

Technical and Scope: Recommendations

- The external beam extinction system needs to be included in the base. The risks of depending solely upon the internal AGS system are too high.
- An active cosmic ray shield needs to be included in the base. Without it MECO will fall far short of its goal.
- The Collaboration needs to develop a realistic strategy for recruiting the additional scientific and technical personnel necessary to carry out the construction in a timely manner.

WBS 1.3.1 MECO Extinction

- Finding: The extinction system, reaching a level of 10**(-9), is essential to ensuring that MECO can achieve its scientific goals

- Comments: Previous short tests in the AGS resulted in extinctions of 10**(-3) at 24 GeV and 10**(-7) at 7.4 GeV

- Recommendation: The external extinction system must remain in the MECO detector base and not be treated as RSVP contingency

WBS 1.3.3 Muon Beam Line

- Comments: Contains passive detector elements – conventional Vacuum system, collimators, neutron absorber, stopping target proton shield, muon beam stop, feedthrough bulkhead

- Recommendation : add manpower

WBS 1.3.4 MECO Straw Tracker

- Scope
  - The straw tracker is well scoped and developed and is adequate for the purpose of measuring electron momenta around 105 MeV with precision of 0.2%.
  - The reviewers suggest that the transverse tracker is the better choice for reasons of simplicity of construction, modularity, alignment, repair, and maintenance. Moreover, the transverse tracker design places wire supports, manifolds, and electronics naturally at the outside circumference, while the longitudinal tracker distributes it radially, placing it in the path of the electrons entering and exiting the tracker.
- manpower
  - the Syracuse group has successfully delivered on similar projects in the past. However, as in many other tasks, much of the manpower is undergraduate and graduate student labor, and unspecified physicists and postdocs. Mechanical and electrical engineering and draftsman manpower must be added to the project to detail the conceptual design.
- schedule
  - The schedule contains much float and is adequate

WBS 1.3.4 MECO Straw Tracker (continued)

- risk
  - gas leakage into the vacuum is the largest concern, and a way to shut off flow to individual sub-modules of straws should be implemented. Testing during construction/assembly should ensure an adequate safety margin.
  - The transverse tracker is a conservative design. However, a calculation of the expected integrated charge per cm must be done. Furthermore, space charge effects from the immediate "flash" in the inner straws may occur and distort positions.
  - Heat management is probably fine, but should be studied in greater detail
  - The tracker module support system must be detailed in view of the 100 μm position resolution requirement

WBS 1.3.5 MECO Electron Calorimeter

- Scope
  - The electron calorimeter is well scoped and developed and is adequate for the purpose of measuring electron energies around 105 MeV with precision of 6%, and position resolution of ~ 1 cm, for use as trigger, cross check of the momentum measurement, and seed for tracking (if the transverse tracker design is adopted). Prototype tests show that the performance goals are reached with proposed design.
- manpower
  - As in almost all other tasks, much of the manpower is undergraduate and graduate student labor, and unspecified physicists and postdocs. Mechanical and electrical engineering and draftsman manpower must be added to the project to detail the conceptual design.
- schedule
  - The schedule contains much float and is far from the critical path

WBS 1.3.5 MECO Electron Calorimeter (continued)

- risks

  - The PbWO4 manufacturer must be selected and costs (and exchange rates) may vary significantly from now to the time of requesting quotes.

  - radiation damage of APD's is a (slight) concern.

  - The proponents have found that not all APDs have adequate speed/rise time, and that the APD procurement may have to involve selection of the devices at the manufacturer, which may involve a substantial cost increase (probably within contingency).

  - Cooling of the PbWO4 crystals (and APDs), essential to improve light yield and S/N, must be detailed.

  - The support structure of the eCAL must be detailed.

WBS 1.3.6 MECO Cosmic Ray Shield

- scope
  - The Cosmic Ray Shield (CRS) is essential for the physics reach of MECO, and as such belongs squarely in the baseline proposal.
  - The Cosmic Ray Shield is still actively under design and its cost might be lowered. With further simulations it may be found that the CRS coverage might be reduced in certain areas (upstream, bottom), without loss of physics reach. Caveat: see below ("risk").
- manpower
  - As in many other tasks, much of the manpower is undergraduate and graduate student labor, and unspecified physicists and postdocs. Mechanical and electrical engineering and draftsman manpower must be added to the project to detail the conceptual design.
- schedule
  - The schedule contains much float and is far from the critical path.

WBS 1.3.6 MECO Cosmic Ray Shield (continued)

- risk
    - Because the backgrounds from target and beam related sources are notoriously difficult to predict, funds may have to be kept in reserve to add additional passive and active shielding after first experience with the beam.
    - Because of the above, the contingency in the CRS cost should be raised to 50%.

WBS 1.3.7 MECO Trigger & DAQ

- Findings
  - MECO plans to use a calorimeter-based level 1 trigger with an expected rate of 1 kHz
  - A level 3 processor farm will do more detailed reconstruction and reduce the rate-to-tape to approximatively 100 Hz, corresponding to 5 MB/s
  - The system requires 8 custom modules, all of which can very likely be built using current technology

WBS 1.3.7 MECO Trigger & DAQ (continued)

- Comments:
  - While none of the necessary custom hardware components appear to be particularly challenging, they remain custom projects and as such need appropriate attention
  - The level 3 cpu needs estimation requires some attention and a corresponding reevaluation of the cost
  - Milestones for individual components are adequate, but integration milestones are missing
  - The clock distribution scheme is not well defined yet, such that a contingency of 16% seems low

WBS 1.3.7 MECO Trigger & DAQ (continued)

- Recommendations:
  - Define integration milestones for the custom electronics
  - Improve level 3 cpu needs and revise the corresponding cost estimate
  - Increase the contingency on the clock distribution scheme to reflect the uncertainty on the architecture (+ $27,960)
  - Identify sufficient physicist manpower soon

WBS 1.3.8 MECO Simulation and Offline Analysis

- Findings:
  - The assessment of simulation and offline needs is credible, and goals and milestones seem appropriate
- Comments:
  - It is important that sufficient physicist manpower be identified to work on this
- Recommendations:
  - Allocate manpower soon

WBS 1.3.9 MECO Integration and Installation

- Finding: Detailed design of the major MECO systems is underway

- Recommendation: MECO needs ½ FTE Mechanical Engineer and ½ FTE Electrical Engineer immediately to begin integration of the major detector elements

April 8, 2005

WBS 1.4 AGS $48,963

York & Kourbanis

Findings:

The team was well prepared. Given their experience with RHIC and SNS they are an experienced group and this was in evidence.

They had detailed performance specifications and concomitant cost and schedules suitable to meet these specifications. The required systems were all very similar to elements existing at BNL and hence, the staff was very familiar with all aspects from design to commissioning. This provides a high level of confidence in their estimates.

Comments:

25MHz The only identified schedule risk was the 25 MHz cavity to be supplied by TRIUMF as an in-kind contribution from the Canadian collaboration. The risk stems from not having control of the monetary resources or personnel. The TRIUMF group certainly has the expertise to deliver the product as required.

Beam Extinction The ring-based extinction system for MECO has only been tested at very low intensity. Given the high tolerance of 10^{-9}, this is a cause for some concern because we can not predict the behavior at this level at high intensity. On the other hand there is complimentary system to be installed in the MECO extraction line. Since either system – in principle – may provide the 10^{-9}, this is a good risk mitigation strategy. Early beam-based tests with high intensity are not viable because of beam activation issues.

100 MHZ Cavity A new 100 MHz cavity is required for KOPIO beam width of 200 ps (rms). Without this cavity, experimental data suggests a beam width of 260 ps. It will take approximately 3 years before this cavity is available and as a consequence a decision must be made early enough to accommodate this duration.

Recommendations:

It is highly recommended that both beam extinction systems be included in the project baseline. The planned beam extinction simulations should be carried out as soon as possible and be available to bench mark the early beam tests.

To ensure schedule and performance compliance, an alternative procurement strategy should be developed for the Canadian 25 MHz structure and a date-certain developed by when a decision needs to be made.

Consideration should be given to recasting the “management contingency” that includes a clean definition of the project scope.

It is suggested that the KOPIO performance be evaluated for beam widths with and without the 100 MHz cavity.

Solenoid Technical, Cost and Schedule - Brindza/Fisk

General Technical Comments

1 The MECO Magnet Team lead by Brad Smith MIT/PSFC has adopted an acquisition strategy for the MECO Magnet System that has been identified as the major critical item for RSVP that clearly and convincingly reduces the risk of this system to the lowest possible. This strategy requires that the MIT team complete the final design of the entire MECO magnet system prior to launching the procurements for these magnets and then providing the necessary follow up procurement contract management and oversight. We endorse this approach.

2 The MECO Magnet effort is supported by a comprehensive integrated cost and project schedule that was demonstrated to be a valuable tool for planning this long and important phase of the RSVP project.

3 The MECO Magnet system design is mature and is clearly beyond the Conceptual Design Phase and is ready for final design and procurement.

4 We note that several of the recommendations of the previous MOG review are being actively considered by the MECO magnet team for inclusion in the project, to the overall advantage of the project. The use of Helium for the magnet shield has already been included and the change of the PS cooling scheme to conduction cooling and the use of Thermal siphon cooling for all solenoids are being actively pursued and will likely result in technical and cost benefits.

   We further note that the excellent BNL designed digital quench detection and protection systems have been retained.

5 The plans for the MECO Helium cryoplant acquisition that were presented were coherent and technically well matched to the Magnet system design heat load with a 150 % capacity margin.

6 We note that the cost target provided by Project management was not met in the MECO magnet system cost estimate. We encourage the Team to try to meet this goal.

Cost Comments

1. Brad Smith has produced a fully integrated MS Project basis for the solenoid systems cost.

2. The MECO Magnet cost book presented is detailed, complete and has a complete BOE basis. The Cost sheets match and roll up.

3. Several WBS items were examined in detail down to the source documents successfully.

1.5.2.11.5 DS Mandrel
1.5.2.11.6 DS coil winding
1.5.2.11.7 DS coil potting
1.5.2.11.8 DS coil electric testing

1.5.2.11.14.1 DS vacuum vessel (small discrepancy relative to backup)
1.5.2.15 Power supplies, QD, QP
1.5.2.15 and 17 Cryogenics - Lots of great detail and backup but cost sheets were in flux and not yet at a mature stage.

4. We note that the cost of the MECO Magnet system has changed substantially over the last few years and have the following observations on the origin and basis of the cost changes.

Winding Tooling	6.8 M$	New scope due to advanced vendor info.
Iron for PS	1.7 M$	Scope moved in from another WBS
Iron for DS	1.1 M$	New Scope due to environmental concern
Helium Refrig.	2.8 m$	Scope moved in from another WBS
Fabrication Mgmt	4.8 M$	New scope - acquisition strategy
Final Design	5.9 M$	New scope - detailed design strategy

Cost and Schedule

Bill Freeman
Dean Hoffer

Findings

- The RSVP project has adopted Microsoft Project 2003 as its cost and scheduling tool.
- Hierarchical resource-loaded schedules that reflect the WBS structure of the RSVP project have been created for each of the WBS level 2 subprojects.
- Task relationships have been incorporated into the schedules.
- Milestones have been included in the plan.
- Tasks have been assigned labor and material resources that permit the extraction of time-phased resource and budget profiles for the project. Labor resource costs generally are prorated over task durations, while material resource costs generally accrue at the start of the tasks to which they are assigned. Thus budget profiles extracted from the schedule represent obligation profiles.
- Costs are in FY05 dollars in the schedule files; escalation is done outside MS Project.
- Indirect costs are included as part of the labor and material resource rates.

Findings (cont'd)

- Contingency is incorporated into the schedule files in a bottoms-up way using the "Lockheed method" of assessing technical, schedule, cost, and design risk factors and combining them with weighting factors to arrive at an overall contingency percentage for each task. Additional management reserve has been assigned by the Project Office in a top-down way, year-by-year and external to the MS project files, to yield an overall project contingency of ~45%
- Backup material for assumed labor rates was not included in cost book material.
- (Summary) tasks against which actual costs are planned to be reported have not been designated in the schedule.
- An Access database is under development which is intended to serve as the mechanism for merging actual costs from the BNL accounting system and, eventually, university-based actual costs, with budgeted costs from the schedule to produce various monthly financial reports such as a CPR.

Comments/Observations

- Some tasks have no successors even though they would appear to require them.
- Some tasks/milestones use fixed dates (i.e. constraints) instead of establishing appropriate links to predecessor/successor tasks.
- Some tasks have no resources assigned even though they would appear to require them, based on the task descriptions.
- Some tasks appear to have mis-designated task types and/or have mis-selected the "effort-driven" option.
- Some tasks have anomalously short durations.
- Some material resources are defined to accrue in a prorated manner rather than at the start of the tasks to which they are assigned.
- Some material resources have incorrect institutional assignments.
- Somewhat different standard calendars and default values for hours per day or week, and days per month are used in different subproject files
- Slightly different assumptions about labor-to-FTE conversion factors were assumed for different subprojects.
- The PMP states that earned value reporting will be required for the subprojects. The concept seemed foreign to some project personnel.

Recommendations

- The RSVP project should seek to eliminate inconsistencies among the WBS level 2 subproject schedule files so that an integrated RSVP-wide project schedule file can eventually be created.
- The subproject staff should comb through their schedule files together with a person knowledgeable in Microsoft Project to resolve the items listed in the comments and thus improve the credibility and integrity of the MS Project schedules.
- Labor rate backup material should be added to cost books.
- Identify (summary) tasks against which actual costs will be reported.
- Project management personnel should assess the impact of reporting earned value against a baseline that represents an obligation profile rather than a cost profile. Consider how the baseline would need to be modified to obtain a cost profile that would be more proper for earned value reporting purposes.
- The RSVP Project Office and Level 2 subproject management should determine whether "Buy American" applies to any of their key procurements and, if it does, assure that the associated procurement task durations take the need for this additional step into account.
- A number of procurement activities are scheduled to begin on Oct 1 of various fiscal years. The project should examine whether the assumption of such start dates for key activities is credible and whether the availability of forward funding could facilitate such early-fiscal-year starts for these important activities.

Other Suggestions

- Consider using a task text field to label each task with its particular source of funding
- Consider using a task field to designate the task's responsible institution.
- Consider using two task cost fields to contain each task's labor and material cost. These values can be extracted from a task's assigned resources by running a visual basic macro.
- Consider using additional resource rate tables to incorporate both burdened and unburdened rates, and/or escalated rates etc. Toggle between the various rate tables by using a macro that changes the rate table associated with each resource assigned to a task. This eliminates the need to maintain two sets of schedule files (burdened and direct), as is currently being done for the AGS schedule, for example.
- Consider saving more than one baseline for the schedule, for example one that represents the obligation profile and one that represents the performance measurement baseline used for earned value reporting.

Management

(Bock,Elioff,Temple,York)

- Findings and Comments
  - RSVP is in a state of development between the milestones of conceptual design (CD1) and preliminary design (CD2). Accordingly the project's costs, schedule, organization, and manpower are in early stages of development. Apart from technical complexities a project of this size is the unique mult-university partnership that does not include the host major laboratory as a sponsor.
  - It is recognized that much good work has been accomplished over the last months; however much more must be achieved over the next year in order to achieve project approval and the desired shedule.

Recommendations

- Continue to formalize the cost and schedule required for preliminary design (CD2) with detailed backup data from all systems. Indications are that this stage is perhaps a year away.
- Develop the subsystem organization charts nd the overall staffing plan that meets the project needs. Apart from technical systems, the overall management and management support staffing needs attention.
- The contingency for this state of the project appears low when compared with other major projects. The current state of the special needs of this complicated collaboration and project (including the acquisition of manpower) need attention. The contingency estimate should be re-evaluatedand the concept of ‘management contingency’ should be reconsidered.

Comments on Contingency

- The committee feels that the project should include all scope in the baseline estimate.
- AGS sub-committee thought perhaps 30% was the appropriate amount of contingency; the MECO Magnets subcommittee thought 45%; the committee at large did not feel that the Detectors needed more than 45%.
- However, the Management sub-committee disagreed and suggests that at this stage perhaps the number is 60%-70%
  - With lab 'backstopping' and better budget climates the estimates under similar situations used to be 50%
  - The BNL Director pledged to do everything he could to support RSVP as long as NSF provides the necessary funds. DOE wants the project to succeed, but will not backstop the program financially.
  - A complicated, unproven funding and management structure
  - 15 months away from preliminary designs,
  - manpower lacking project wide . No clear plan to fill the gaps. The holes not listed,
  - Embryonic project
  - management costs are underestimated
  - overall tight budget climates for science will exacerbate all this

Recommendations

- Consider some sort of monthly oversight meeting with representatives if the Lab, agencies, and universities who control resources that you use and need to help assure that this complicated thing stays in track.
- ‘Reviewmanship’
  - Spend every day the next weeks further scrubbing the project plan and presentations. Talks were too long.
  - Some tables do not roll up (burdening, escalation, costs vs obligations, manpower units....must get right and every number needs to come from the project office
  - Some material as transposed to the review website PDF was truncated
  - Identify your manpower needs in a summary form
  - You have to control these things or you will fail.

RSVP Charge Questions

1. **Technical/Scope: Does the proposed design and associated implementation approach satisfy the performance requirements? Is the project scope appropriate in order to realize the scientific goals?**

   Technical/ Scope

   The proposed designs for MECO and KOPIO including the AGS modifications should satisfy the performance requirements.

   The project scope appears matched to the scientific goals of the experiments.

   RSVP Recommendations

   The full project should be included in the cost and the management contingency removed.

   NSF, DOE, and BNL need to support RSVP by funding collaborators. This cost is extremely modest relative to the cost of RSVP, and is needed for the success of the project.

2. **Cost Estimates: Is the cost estimate consistent with the plan to deliver the technical scope with the stated performance? Is the contingency adequate for the risk?**

   The RSVP base MREFC cost estimate of ~$181M (AY$) is credible and consistent with the technical scope and desired performance for a project at this stage of development.

   The total pre-op and engineering and commissioning cost estimate of $15.5M (AY$) is judged to be adequate and consistent with the need.

   A contingency percentage of ~45% or more is judged to be adequate for a project at this stage of development.

3. **Schedule: Is the proposed schedule reasonable and appropriate in view of the technical tasks and proposed funding profiles? Has the critical path been identified?**

   Resource loaded schedules have been developed for all parts of the RSVP project.

   The schedules are at different levels of maturity.

   The current schedules indicate that the MECO Solenoids are the critical path for the RSVP project.

   Based on the current maturity of the schedules a firm conclusion about whether the schedules are reasonable and appropriate cannot be determined for the project as a whole.

Further work and refinement of the schedule are required before a more thorough assessment of the schedule can be ascertained with a high level of confidence.

4. **Resources: Is the proposed estimated resource allocation adequate to meet the goals of the project? Are the manpower needs well understood, and is the ramp up of these resources realistic? Is there an appropriate mix of expertise represented in the proposed manpower profiles?**

While the estimated resource needs seem reasonable

- Some tasks are scheduled to be completed by physicist where a computer professional/engineer/technician may be more appropriate

A large fraction of the required personpower remains unidentified, and even if identified very soon it will be challenging for them to ramp up fast enough to meet the schedule

The collaborations need to attract more groups on a short timescale, a number of these with electrical engineering expertise

In addition, existing groups need to expand

5. Operations: Is the plan for operating the experiments reasonable? Are the costs well understood and characterized?

Operations costs:
In Lowenstein's talk, RSVP operations were presented on Slide 14. In comparing with RHIC costs in the same epoch, the following was noted:

	RHIC	RSVP
Salary Cost/FTE	\$40M/382=\$105k	\$2.1M/19=\$110k
Overhead/Proj Cost	\$37.6M/\$102.2M=0.37	\$3.4M/13.5M=0.25

It can be seen that the FTE cost for RHIC and RSVP are essentially the same. The variation in overhead rate was raised, and it was then discovered that the RSVP scenario presented was close to the worst case cost – RSVP running in a year in which there is no RHIC running. Pile's numbers for various forms of RSVP/RHIC running are as follows:

RSVP running with RHIC PP = \$8.7M/yr
RSVP running with RHIC HI = \$10.1M/yr
RSVP running w/o RHIC = \$13.9M/yr

So the real cost for operations will probably be an average of the above scenarios.

It should be noted that the escalated salary cost and overhead rates to RSVP in the RHIC era are similar to those of NP in the AGS/HEP era.

Operations manpower: In the above estimates, ~19FTE of manpower are included for RSVP (compared to 382FTE for RHIC). This level of effort directed to RSVP and discussed by Lowenstein in Slide 15 appears reasonable.

Construction manpower: Near the end of the construction project circa 2010-2011, manpower drops to 20FTE and below (presentation by Al Pendzick Slide 9). In this period, the Preops will transition to Ops, estimated to be ~19 FTE. The project should review the number of personnel needed in this time frame, but Pendzick and Lowenstein estimates appear to be consistent with each other.

6. **Management: Is the proposed management structure and process adequate to deliver the proposed technical scope within specifications, budget, and schedule? Are there sufficient resources allocated to management to allow it to function effectively?**

   Yes, the proposed management structure and process appear to be adequate to deliver the proposed technical scope within specifications, budget, and schedule.

   No, there are NOT sufficient resources allocated to management to allow it to function effectively. Additional project management staff are required at Stony Brook and University of California at Irvine.

7. **Risks and Mitigation Strategies: Have the risks for the cost, schedule and scope been identified? Are there adequate mitigation strategies for these risks?**

   Several categories of risk have been identified by the project including technical, manpower, and integration activities. Technical risks have included the extinction problem, the large volume-thin walled vacuum chamber, and the MECO magnet. In each case the project has developed technical solutions or proposed R&D to mitigate the risks with some signs of success.

   Lack of manpower is evident across the project. There have been some recent additions. There are potential reductions in some areas. A formal approval will help the project grow. Manpower will continue to be a serious problem. Contingency has been increased to 45%. We believe it should be further increased.

   Complex management challenge in a hostile budget climate

   - NSF project at a DOE Lab
   - International collaboration and funding
   - NSF/DOE MOU and Joint Oversight Group are signs of mitigation attempts

EXECUTIVE SUMMARY CLOSEOUT REPORT ON PRELIMINARY BASELINE REVIEW FOR RSVP

INTRODUCTION

The Rare Symmetry Violating Processes (RSVP) project is a National Science Foundation (NSF) initiative composed of two elementary particle physics / high energy physics (EPP/HEP) experiments to be carried out at the Brookhaven National Laboratory (BNL). Both experiments K0PI0 and MECO are largely University collaborations focused at Stony Brook and University of California at Irvine respectively. An RSVP Project Office has been established through Columbia University and given responsibility to manage the complete enterprise. The Alternating Gradient Synchrotron (AGS) at BNL will be modified / upgraded as part of the project to provide intense proton beams for the RSVP experiments.

TECHNICAL

RSVP is comprised of five pieces: 1) Project Office, 2) K0PI0, 3) MECO, 4) AGS Upgrades, and 5) the MECO Magnet. Conceptual Design Reports (CDR) have been prepared for all four technical components of the project. The NSF Baseline Review is being held at the CDR rather than at the preliminary design report (PDR) stage where DOE presently baselines projects. Until a few years ago, DOE baselined projects at the CDR stage (for example CMS and ATLAS), so this seems reasonable for RSVP as long a appropriate increased uncertainties due to a less complete design are taken into account.

It appears that the AGS Upgrade has quite a thorough CDR. Significant effort and resources have been placed on concept development for the MECO Magnet. Recent reviews have been conducted by the RSVP Project Office of experiment Simulations, the MECO Magnet, and the AGS Upgrade.

The committee finds the progress to date provides a reasonable basis for proceeding into preliminary design for the project.

COST

A base MREFC cost of $167.9M FY05$ was presented for the RSVP project. The Project Director believes ~45% contingency is appropriate bringing the total cost to $246.9M in 05$

A contingency analysis by the level 2 (L2) managers that summed to ~24% overall was presented. No analysis was given to support the Project Office 45% contingency, but a comparison to an equivalent percentage at the baselining of ATLAS was noted.

The committee believes some modest base cost increases are needed but was split in the assessment of an adequate contingency. The technical subcommittees felt the 45% was adequate or were unwilling to suggest an increased amount. The management subcommittee and the chair feel that at this CDR stage, with the proposed management arrangements for an NSF project to be assembled and operated in a DOE lab, and with the current very tight funding climate that a contingency of 60-70% is more appropriate.

SCHEDULE

Schedules for each level 2 subproject have been prepared using Microsoft Project. The schedules have been resource loaded yielding a obligation profile. Based on these schedules and obligation profiles an "actual year" MREFC cost of $282.1M AY$ results when escalation is added.

If the required funding is provided and additional collaborators and staff are brought on board these experiments can probably be mounted on the schedules shown for both to be operating in 2012.

OPERATIONS

Estimated AGS Operations cost for years FY08 through FY16 were presented as $116.9M in AY$. Other costs of beam and detector R&D and decontamination and decommissioning bring this total to $146.0M AY$.

MANAGEMENT

RSVP requires a significant manpower effort. The total manpower must be estimated by category with a plan for attainment. At present there are shortfalls of ~30 to 50% in projected manpower availability.

RSVP is a first of its kind experiment – an NSF funded multi-university collaboration without direct sponsorship / participation of a major laboratory to be assembled and operated at a laboratory facility. The overall Management staff should be estimated ASAP with plans for personnel acquisition. The staffing at the Columbia and BNL Project Offices may be about right, but the PM staff at Stony Brook and UCI must be increased.

The preliminary design of many technical components is underway. The plans for AGS Modifications have been developed with significant details and deserves recognition.

Apparently RSVP plans to use an earned value management system (EVMS). However, an accounting system able to support collection of actual costs for all components of the project has not been identified; one needs to be adapted or developed ASAP. Some appropriate accounting system will be required for sound project management even if an EVMS is not used.

The graphical organization chart shown by the Deputy Project Manager caused much consternation among committee members. Extensive discussions were held with project participants, funding agency representatives, and BNL management including the Director. With enough words and description the chart begins to make sense. After this extensive discussion, we were unable to suggest a better alternative, so we accept the proposed plan on a trial basis with the understanding that RSVP senior management (the Joint Oversight Group) will act swiftly to make changes needed to make the organization work successfully.

OVERALL ASSESSMENT

With some considerable focused effort (primarily by the PD, DPD, and L2 Project Managers) the RSVP project can have a "CDR level baseline" by the time of the NSF Baseline Review to be held April 20 – 22, 2005.